REMARKS

With this response, independent claim 58 is amended to clarify the embodiment of the invention being claimed. As discussed with the examiner in the telephonic interview of December 16, 2009, step d of claim 58 is amended to refer to the "areas" which are illuminated in step c. Other changes to this step are made to improve readability and to ensure antecedent basis, by referring to the two-dimensional light exposure pattern and specifying that the step is a monitoring step. Step c is amended to specify that the two-dimensional light exposure pattern is adjustable. Step e has been combined with step d and has been amended to delete the word "optionally" as suggested by Examiner Gross, and, also as suggested by Examiner Gross, a final clause has been added. This added phrase is based on language from the original specification at page 17, lines 35-38. Applicant submits that this claim is allowable over the art, meets the standards of 35 U.S.C.§§ 112 and 101, and contains no new matter. Applicant thanks Examiner Gross for his agreement to formally consider these claims.

As discussed during the telephonic interview, the invention claimed here relates to a method of biochip manufacture, distinct from a method of using the biochip in a detection (for example, hybridization-type) assay. This method involves positioning a transparent biochip carrier between an illumination matrix and a detection matrix such that light from the illumination matrix is transmitted through the carrier, illuminating it, and then falls on the detector matrix where it is detected. This illumination of the biochip carrier from the illumination matrix produces a two-dimensional pattern of light on the carrier, selectively illuminating predetermined areas of the carrier. During the interview, various potential amendments were discussed with the goal of producing a claim that was distinguishable over the previously cited references.

In order to ensure that the intended areas of the carrier are being illuminated, a monitoring and quality control step is performed where the location of the illuminated areas on the carrier is detected. Using the information from the

detector matrix, the exposure pattern of the light is adjusted. This monitoring and adjustment allows superior quality control during manufacture because the maker can be alerted to irregularities that previously were not detected and corrected.

Applicant submits that this claim is distinguishable from and patentable over Pirrung, which discloses a mask technology for biochip manufacture. Pirrung discloses a detection apparatus "for identification of locations where binding takes place" on the already-manufactured chip, i.e. to detect fluorescent label on bound or hybridized analytes. See e.g., col. 4, lines 15-16, col. 10, lines 46-49. For biochip manufacture, however, no detection apparatus is used, and no monitoring or quality control device or method is disclosed or even suggested.

The only detection discussed is of fluorescent signals in chip use. The claims here, however, specifically recite illuminating to create a two-dimensional light exposure pattern and monitoring this pattern to detect the location of the illuminated areas on the biochip carrier. This feature is not discussed in Pirrung. Although Pirrung uses a computer to design a masking program and a fluorescence detection device, there is no aspect of Pirrung's method that even hints at the monitoring and quality control feature of these claims.

Applicant submits that claim 58 also is distinguishable from and patentable over Cerrina. This reference describes projecting with an illumination array, which is operated under the control of a computer, programmed to cause appropriate micromirrors to be in the "reflect" or "deflect" (on or off) position. See col. 3, lines 46-49. Cerrina nowhere discusses any monitoring or quality control of the illumination pattern or any method to determine if the correct areas of the biochip are being illuminated. The drawings in Cerrina do not show any detector in the synthetic apparatus and the text describing control of the operation involves only coordination of illumination (the on or off position of the micromirrors) and the application reagents. There is no hint whatsoever that this process could be monitored by a detector or adjusted to correct any defects in the illumination pattern.

The Derndinger reference also does not teach or even suggest an apparatus where the location of the illuminated areas in the two-dimensional pattern of illumination is detected in any way, much less monitored and adjusted in response to the detected pattern. There is no mechanism provided to detect which zones, areas or pixels in a two-dimensional pattern are illuminated on the object to be imaged in Derndinger. Thus, the claims here are distinguishable from this reference as well.

In combination, the cited references do not even mention a system in which the actual pattern of light impinging on the biochip carrier is detected or where any monitoring step is performed which accomplishes this aspect of the claims. Generally, in the prior art, the only monitoring done is to detect whether a mask has been positioned correctly over a biochip carrier, usually by detecting whether the edges or the corner of the mask is located at the correct location over the carrier. This, however, in no way involves detecting the pattern of light going through the mask and onto the biochip carrier in two-dimensions. Thus, there would be no way to determine if the mask was damaged, or clogged, or if the wrong mask had been inserted, or to determine whether the light actually was impinging on the correct locations.

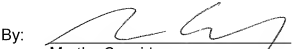
Analogously, when using an illumination matrix rather than masks, using the previous methods in the art, no detection and monitoring step was employed, and there was no method to determine if the wrong sequence of illumination patterns had been entered, or if the micro-array was defective such that some of the lasers or mirrors were not functioning properly, or if dust and debris had somehow interfered with the light transmission to the carrier, or any technical difficulty had arisen which would result in inaccuracies in the chip manufacture. This invention allows the manufacturer to be alerted if the wrong pixels are being illuminated and to take corrective action by adjusting the light pattern. None of the prior art provides such a feature or even hints at a method to accomplish this. The present invention has advanced the ability to manufacture biochips in a totally automated setting, with quality control that results in a superior product.

Applicant submits that the present claims are distinguishable from each of the cited art references individually and from the references in combination. Each of the references lacks the feature of monitoring the two-dimensional pattern of light (the actual locations on the carrier being illuminated) to allow the operator to adjust the locations of illumination. Even together, the features that are disclosed do not combine to teach or suggest the claim here.

Applicant would like to refer the office to the following disclosures in the present specification that explain the invention and support the claims. Page 17, line 34 to page 18, line 4 discuss monitoring exposure of the carrier and, where, appropriate, controlling the exposure using the facing illumination and sensor matrices. Page 35, lines 31-37 refer to using a light detection module for online quality control of light-dependent processes such as in situ synthesis of a microarray. Page 39, line 29 to page 40, line 2 discuss Figure 7, which shows the sandwich structure of the device and discuss how the light valve (illuminator) matrix and the CCD (detector) matrix are controlled by a shared unit so both are used simultaneously. The specification as a whole describes a system which allows detection of irregularities in production and adjustment of the light pattern to ensure quality control. See, for example, page 18, lines 25-31; page 34, lines 13-1; page 9, lines 33-37 and page 14, lines 9-19 of the specification.

Applicant requests entry of the amendments herein and favorable consideration of the application.

Respectfully submitted,

By: 

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